

The **American Fertilizer**

Vol. 98

JUNE 19, 1943

No. 13



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NITRATE of SODA

•
SULPHATE of AMMONIA

•
ORGANIC AMMONIATES

•
SULPHUR
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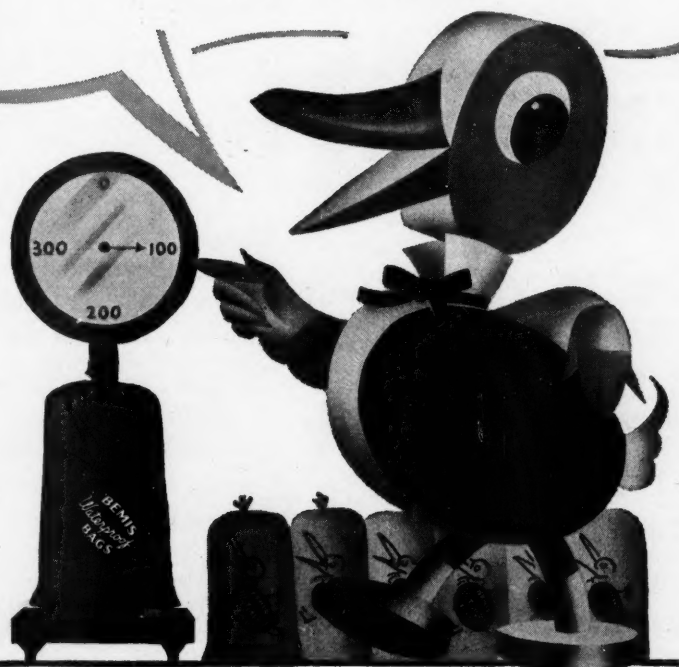
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AMERICAN FERTILIZER

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Factors Affecting the Availability of Ammoniated Superphosphates—Part 1*

By JOHN O. HARDESTY, WILLIAM H. ADAMS (Associate Referee) and

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THE water-insoluble phosphates in ammoniated mixtures differ as a rule from those in the ordinary types of non-ammoniated mixtures in that they show greater differences in their solubility in citrate solution. As a result of these differences in citrate solubility, the official method may sometimes indicate a higher availability for a water-insoluble phosphate in low than in high analysis mixtures, and in mixtures than in the undiluted material (12)†. This defect in the method becomes increasingly objectionable with increase in the ammoniation of the mixture and its concomitant increase in the water-insoluble phosphates formed in the reaction.

Owing to the recent greatly increased capacity of the United States for producing synthetic ammonia, the cost of this form of nitrogen is likely to be still further reduced following the war. It would therefore seem to be of considerable economic importance to know not only the maximum quantity of free ammonia that can be added to a fertilizer mixture without reducing the availability of the phosphorus to plants, but also to have an accurate means for evaluating such a mixture.

In accordance with a recommendation (11)† that was approved last year, a further study

was undertaken of (1) the factors that affect the chemical availability of the P_2O_5 in ammoniated mixtures; (2) the efficiency of ammoniated mixtures in promoting crop growth; and (3) improved means for the more accurate evaluation of such mixtures.

The present paper is limited to a study of the factors that affect the chemical availability of the P_2O_5 in ammoniated mixtures. Data on the availability to plants of ammoniated mixtures of varying composition and on proposed methods for the more accurate valuation of such mixtures will be presented in subsequent papers.

Factors Affecting Reversion of Ammoniated Superphosphates

It is known that the rate and extent of the reversion of P_2O_5 in an ammoniated superphosphate, as determined chemically by the official method, depend on such factors as the degree of ammoniation (5, 6, 12, 14), the rate at which the mixture cools following ammoniation (2, 3, 4), and the presence of such component materials as fluorides and dolomite (7, 8, 9, 10). Thus, marked reversion, as determined by the official method for phosphate availability, is known to take place when a heavily ammoniated superphosphate-dolomite mixture is slowly cooled from its initial ammoniation temperature (6), but the reversion is much less if the mixture is quickly cooled, particularly in the absence of dolomite (2, 3, 4). Although many of the factors that affect the availability of ammoniated superphosphates are thus fairly well understood, the effect of

*Report of the Committee on Phosphoric Acid of the Association of Official Agricultural Chemists. Presented in part at the meeting of the American Chemical Society held at Buffalo, N. Y., Sept. 7-11, 1942.

†Numbers in parentheses refer to literature listed at the end of the article.

other factors is not so well understood, and this is particularly true with respect to the effect of the different factors mentioned on the efficiency of ammoniated mixtures. Thus, while it is known that reversion in a heavily ammoniated superphosphate mixture can be decreased by rapid cooling of the mixture, it remains to be demonstrated that the efficiency of the mixture in promoting crop growth can be increased by the same treatment.

The different factors affecting ammoniated superphosphate availability to which special attention is given in this study are (1) the degree of ammoniation of the mixture; (2) the storage temperature of the mixture following ammoniation; (3) the moisture content of the mixture during ammoniation and storage; (4) the sources of the superphosphates used in the preparation of the ammoniated superphosphate mixtures; (5) the presence of dolomite in the mixture during ammoniation and storage; and (6) the presence of fluorides in the mixture during ammoniation and storage.

Ammoniated Superphosphate Mixtures

The ammoniated samples used in this investigation were prepared in the form of 4-12-4 mixtures. The formulas of the mixtures, when the free ammonia added was varied from 0 to 5 per cent on the basis of the superphosphate present, or from 0 to 60 pounds per ton, are given in Table I. The total nitrogen content of each mixture was kept constant by the addition of the necessary quantity of ammonium sulphate. The proper quantities of potassium chloride, dolomite, and filler to give a mixture in each case of the desired grade were added to each mixture prior to ammoniation. In the second, third, fourth, and fifth mixtures, the free ammonia was added in the form of solutions of ammonia of such concentrations that the moisture content of each mixture was increased to 9 per cent when the specified quantity of free ammonia had been added. The mixtures were ammoniated in a stainless steel rotating drum mounted on trunnions. Each ammonia solution was sprayed into the mixture in the drum by being forced under pressure through an opening in one of the trunnions of the drum. The ammoniation of each mixture was completed in 3-4 minutes.

In preparing another mixture according to the fifth formula of Table I, the ammonia was added in the form of anhydrous ammonia to a mixture containing less than 1 per cent of moisture. It was found that a dry mixture of this kind will not absorb anhydrous ammonia

until the temperature of the mixture is increased to about 45°C. Once ammoniation started under these conditions it proceeded rapidly with a marked increase in the temperature of the mixture. Its moisture content also increased to 3 per cent due to liberation of the hydrated water in the mixture. All mixtures were kept below a temperature of 65°C. during ammoniation by the addition of water when necessary to the outside of the drum. Each mixture, on being ammoniated,

TABLE I
FORMULAS OF AMMONIATED 4-12-4 MIXTURES
CONTAINING SUPERPHOSPHATE A

Material	Pounds Per Ton					
Superphosphate A, $P_2O_5=20.34\%$	1180	1180	1180	1180	1180	1180
Free Ammonia	0	24	36	48	60	60
Ammonium Sulphate, $N=20.51\%$	390	292	244	195	146	146
Potassium Chloride, $K_2O=50.12\%$	160	160	160	160	160	160
Dolomite	250	250	250	250	250	0
Filler (sand)	20	94	130	167	204	454
	2000	2000	2000	2000	2000	2000

TABLE II
CITRATE-INSOLUBLE P_2O_5 IN AMMONIATED 4-12-4
MIXTURES CONTAINING SUPERPHOSPHATE A

(Initial citrate-insoluble $P_2O_5=0.74\%$)

Ammoniation rate		Increase in citrate-insoluble P_2O_5 in samples stored for 36 days at—				
Per cent of superphos.	(lbs. NH_3 /ton)	Moisture per cent	Dolomite	20°C	60°C	90°C
				per cent	per cent	per cent
0	0	9	Present	0.01	—	—
2	24	9	Present	0.01	0.28	2.60
3	36	9	Present	0.01	0.38	2.81
4	48	9	Present	0.07	0.63	2.75
5	60	9	Present	0.19	0.59	1.73
5	60	3	Present	0.00	0.47	0.32
5	60	9	Absent	0.01	0.42	0.26

was passed through a 10-mesh screen and thoroughly mixed.

The mixed samples as prepared were divided into three portions. One portion was quickly cooled and stored at 20°C.; the second portion was stored at 60°C.; and the third portion at 90°C. The samples were all stored in large, wide-mouthed bottles for a period of 36 days. Any considerable loss of moisture from the samples during storage was prevented by having a long glass tube pass

through the stopper in each bottle and extend for a distance of about two feet through the top of the constant temperature chamber in which they were stored. The stored samples were finally airdried and ground to pass a 40-mesh sieve.

The results obtained in the analysis of the samples are given in Table II. It will be seen that when the samples were stored at 20°C., no increase in citrate-insoluble P_2O_5 occurred as determined by the present official method, even at 5 per cent ammoniation. A significant increase in citrate-insoluble P_2O_5 took place when separate portions of the same mixtures were stored at 60°C. and still more when the storage temperature was increased to 90°C. It will be seen that the citrate-insoluble P_2O_5 in the mixtures stored at temperatures above normal as essentially the same at 2 per cent ammoniation as at 5 per cent. This held true with the mixtures prepared from the particular superphosphate used in these experiments. With mixtures prepared from superphosphates obtained from other sources, the citrate-insoluble P_2O_5 was sometimes found to show a marked increase with increase in the rate of ammoniation beyond 2 per cent. That different superphosphates sometimes react differently on ammoniation has frequently been observed in the industry.

Although no appreciable increase in citrate-insoluble P_2O_5 , as measured by the present official method, took place on storage at 20°C. in any of the mixtures represented in Table II, a considerable reversion was indicated when a 2-gram sample was taken for analysis, as in the old official method, and the extent of the reversion increased with increase in the rate of ammoniation.

Table II further shows that no serious reversion occurred in any of the mixtures containing 3 per cent of moisture even when ammoniated to 5 per cent and stored for 36 days at 90°C. The same held true for the dolomite-free mixtures containing 9 per cent of moisture. It would seem, therefore that the dolomite in association with moisture was responsible for the greater part of the reversion that took place in the mixtures stored at 90°C.

Ammoniated Synthetic Superphosphate Mixtures

It has been shown by MacIntire and his co-workers (7, 8, 9) that fluorine, as calcium fluoride, reacts with tricalcium phosphate to form fluorapatite and that the same product is also formed when calcium fluoride is included in a mixture of triple superphosphate and a basic material such as limestone.

This observation seemed to be confirmed in this laboratory when it was found that the presence of calcium fluoride in an ammoniated monocalcium phosphate sample caused a marked increase in citrate-insoluble P_2O_5 during storage at temperatures above normal (10, 13). The replacement of calcium fluoride with sodium fluoride increases the rate of reaction, and a marked reversion may then take place in the process of making the analysis (10).

It is possible, therefore, that fluorine may play an important part in the fertilizer efficiency of ammoniated superphosphates. A set of fluorine-free and of fluorine-containing synthetic superphosphate samples was accordingly prepared by a procedure similar to that described for the ordinary superphosphate samples. In the preparation of these

TABLE III
FORMULAS OF AMMONIATED 4-12-4 MIXTURES
CONTAINING A SYNTHETIC SUPERPHOSPHATE

Material	Pounds Per Ton					
$Ca(H_2PO_4)_2 \cdot H_2O + CaSO_4 \cdot 2H_2O^1$						
$P_2O_5 = 20.68\%$	1161	1161	1161	1161	1161	1161
Free Ammonia	0	60	0	60	0	60
Ammonium Sulphate, N = 20.51%	390	146	390	146	390	146
Potassium Chloride, $K_2O = 50.12\%$	160	160	160	160	160	160
Calcium Fluoride ²	—	—	49	49	—	—
Sodium Fluoride ²	—	—	—	—	53	53
Filler (sand)	289	473	240	424	236	420
	2000	2000	2000	2000	2000	2000

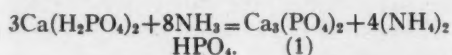
¹ Two mols of $CaSO_4 \cdot 2H_2O$ to one of $Ca(H_2PO_4)_2 \cdot H_2O$.

² Fluorine added equals 10% of P_2O_5 in mixture.

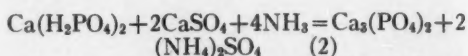
samples, C.P. monocalcium phosphate and calcium sulphate were mixed in the proportion of one mol of the former to two mols of the latter to simulate a commercial superphosphate. These mixtures were used in the preparation of 4-12-4 fertilizers, of which one contained no fluorine, a second contained fluorine as calcium fluoride equal to 10 per cent of the P_2O_5 in the mixture, and a third contained the same proportion of fluorine in the form of sodium fluoride. Each of these fertilizers was of two types, one of which was non-ammoniated, while the other was treated with ammonia at the rate of 60 pounds per ton of mixture. The ammoniated mixtures were divided into two parts, of which one was stored for 36 days at 20°C., and the other for the same length of time at 60°C. The stored mixtures were air-dried and ground to pass a 40-mesh sieve as in the case of the ordinary superphosphate mixtures. The formulas of the mixtures are given in Table III. All mixtures were dolomite-free.

No significant increase in citrate-insoluble P_2O_5 was found on analysis in the non-ammoniated mixtures, nor in those that had been ammoniated in the presence of fluorine to 5 per cent of the superphosphate contained therein. As this result might appear to be at variance with the observations of MacIntire and his associates (7, 8, 9) as well as with the previous tests made in this laboratory (10, 13), the work was repeated on various combinations of materials. The formulas of the mixtures are given in Table IV. It will be noted that all mixtures contained the same quantity of P_2O_5 and were ammoniated to the same degree in relation to the P_2O_5 present. Mixtures 1 and 2 were simply ammoniated monocalcium phosphates; the first contained no fluorine while the second

The reactions taking place on the complete ammoniation of monocalcium phosphate may be represented by the equation:*



When the monocalcium phosphate is accompanied by two mols of calcium sulphate, as in Samples 3, 8, and 9 of Table IV, the complete ammoniation of the mixture takes place by a different reaction, which is commonly represented by the equation:*



In this equation all the phosphorus in the monocalcium phosphate is changed to trical-

TABLE IV
FORMULAS AND ANALYSES OF MISCELLANEOUS FERTILIZER MIXTURES*

Material	Pounds Per Ton										
	1	2	3	4	5	6	7	8	9	10	11
	Formulas										
Double Superphosphate.....										495	495
Monocalcium Phosphate.....	426	426	426	426	426	426	426	426	426	..	..
Calcium Sulphate.....			560	..				560	560	..	..
Free Ammonia.....	60	60	60	60	60	60	60	60	60	60	60
Ammonium Sulphate.....						146	146	146	146	146	146
Potassium Chloride.....						160	160	160	160	160	160
Sodium Fluoride.....		53	53	53	53	53	53	53	53	53	53
Dolomite.....						250		250		250	
Filler.....	53	..	..	560	1461	905	1155	345	595	836	1086
	Analyses										
Increase in citrate-insoluble P_2O_5 after 15 days' storage at 20°C.....	0.04	6.60	2.00	0.82	none	none	none	0.46	trace	trace	none
Increase in citrate-insoluble P_2O_5 after 15 days' storage at 75°C.....	0.45	6.44	1.33	1.15	trace	trace	trace	0.90	trace	trace	none

* Samples 1 and 2 are 9-45-0 mixtures; Samples 3 and 4 are 5-22-0 mixtures; Sample 5 is a 4-12-0 mixture; and Samples 6 to 11 are 4-12-4 mixtures.

contained fluorine as sodium fluoride equal to 10 per cent of the P_2O_5 in the mixture. The table shows that the sodium fluoride caused a marked increase in citrate-insoluble P_2O_5 , as was to be expected from the previous work done in this laboratory (10). Mixture 3 differed from Mixture 2 in that it contained calcium sulphate. In Sample 4 the calcium sulphate of Mixture 3 was replaced with an equal weight of sand, and in Mixture 5 the sand was increased to give a 4-12-0 mixture.

Mixtures 6-11 were ammoniated 4-12-4 mixed fertilizers. In Mixtures 6-9 the phosphatic component was monocalcium phosphate and in Mixtures 10 and 11 it was double superphosphate. It will be noted that none of these mixtures showed any appreciable reversion on storage except Mixture 8, which contained both calcium sulphate and dolomite.

cium phosphate, whereas in Equation 1 only one-third of the phosphorus in the mixture is changed to tricalcium phosphate. It would be expected, therefore, that a greater proportion of the total P_2O_5 in a completely ammoniated monocalcium phosphate would be changed into the citrate-insoluble form when calcium sulphate is present, as in superphosphate, than when it is absent. Keenen (5) has shown that when a superphosphate is ammoniated to the same degree as the mixtures represented in Table IV, the phosphatic components of the ammoniated product consist of about 3 parts of tricalcium phosphate to 1 part of monocalcium phosphate. The product is obtained in acid in reaction. According to

* It is recognized that more basic phosphates than tricalcium phosphate may be formed in these reactions.

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Potash Price Ceilings Established

On June 12th, the Office of Price Administration issued Maximum Price Regulation 404, covering prices on potash salts sold by producers or importers to fertilizer manufacturers or by one fertilizer manufacturer to another. The Regulation, which became effective on June 18th, covers muriate of potash, sulphate of potash, sulphate of potash magnesia, and manure salts. Sales of agricultural potash to consumers are already covered by Revised Maximum Price Regulation 135.

The provisions of the Regulation relating to specific prices for the different potash salts are as follows:

Article II—Maximum Prices

SEC. 4. *Spot sales.* The maximum prices at which spot sales of domestic potash in bulk may be made are:

(a) *For 60 per cent muriate of potash.* The buyer shall have the choice to buy 60 per cent muriate of potash at:

(1) \$.535 per unit of K_2O , basis ex-vessel the potash port nearest freight-wise to the buyer's destination, plus the customary delivery charges from the end of ship's tackle to the buyer's destination; or

(2) \$.455 per unit of K_2O f.o.b. cars at Trona, California; or

(3) \$.423 per unit of K_2O f.o.b. cars at seller's plant near Carlsbad, New Mexico.

(b) *For 50 per cent muriate of potash.* The buyer shall have the choice to buy 50 per cent muriate of potash at:

(1) \$.56 per unit of K_2O , basis ex-vessel the potash port nearest freightwise to the buyer's destination, plus the customary delivery charges from the end of ship's tackle to the buyer's destination; or

(2) \$.48 per unit of K_2O f.o.b. cars at Trona, California; or

(3) \$.448 per unit of K_2O f.o.b. cars at seller's plant near Carlsbad, New Mexico.

(c) *For manure salts.* \$.20 per unit of K_2O f.o.b. cars at seller's plant near Carlsbad, New Mexico.

(d) *For sulphate of potash, basis 90 per cent.* K_2SO_4 , \$36.25 per ton basis ex-vessel the potash port nearest freightwise to the buyer's destination, plus the customary delivery charges from the end of ship's tackle to the buyer's destination.

(e) *For sulphate of potash magnesia, basis 40 per cent K_2SO_4 and 18.5 per cent K_2O .*

\$26.00 per ton basis ex-vessel the potash port nearest freightwise to the buyer's destination plus the customary delivery charges from the end of ship's tackle to the buyer's destination.

SEC. 5. *Contract sales.* The maximum prices at which contract sales of domestic potash in bulk may be made are:

(a) *Contracts executed prior to July 1.* Where a buyer contracts with a producer prior to the first day of July for the purchase of potash for delivery in approximately equal monthly quantities, prior to the 31st day of March next succeeding, the buyer, and any person to whom War Production Board allocates the whole or any part of the potash subject of such contract, may buy:

(1) On ex-vessel sales at the spot sales prices as above set forth, at a discount of 8 per cent where delivery is contracted for in approximately equal monthly quantities between June 1 and the 31st day of March next succeeding, and in addition, at a 4 per cent discount when the full delivery contracted for, or delivery to the extent permitted under War Production Board allocation, has been accepted;

(2) On f.o.b. cars sales, except for sulphate of potash and sulphate of potash magnesia, at the spot sales prices and at the discounts and under the conditions above set forth, and, except for manure salts, at a further deduction of 8 cents per unit of K_2O , in the case of sales f.o.b. cars at Trona, California, and a deduction of 11.2 cents per unit of K_2O , in the case of sales f.o.b. cars at seller's plant near Carlsbad, New Mexico.

(b) *Contracts executed from July 1 to October 1.* Where a buyer contracts with a producer, on and after the first day of July and prior to October 1 of the same year, for the purchase of potash for delivery in approximately equal monthly quantities during the period from October 1 to the 31st day of March next succeeding, the buyer, and any person to whom War Production Board allocates the whole or any part of the potash subject to such contract, may buy:

(1) On ex-vessel sales at the spot sales prices as above set forth at a discount of 4 per cent where delivery is contracted for in approximately equal monthly quantities between October 1 and the 31st day of March next succeeding, and in addition, at a 2 per cent discount when the full delivery contracted for, or delivery to the extent permitted under War Production Board allocation, has been accepted;

(Continued on page 22)

June Crop Report

Crop prospects in the United States are lower than they were a month ago and a little less promising than at this season in any of the last 3 years. By June 1, planting had been seriously delayed by wet weather in important central and northeastern States. At the same time, lack of moisture was causing increasing concern in portions of the Great Plains. Rainfall has been more evenly distributed since June 1 but in the wet area planting is progressing under difficulties and farmers probably will not be able to increase the acreage of crops as desired. In the flooded areas and where the rains have continued into June many farmers will have to plant whatever the lateness of the season permits. If weather is reasonably good from now until harvest, the acreage of crops grown should be nearly as large as was harvested last season and crop yields should approach those of the 1937-41 or post-drought period; but either further delays in planting or an early frost would be costly. Some crops may yield well, but aggregate yields averaging as high as those secured last year are no longer within reach.

During May, persistent rains fell from southwestern Oklahoma to central Michigan and northern New York. This strip is roughly 1,500 miles long and 300 miles wide and includes about 90 million acres of crop land or a fourth of all crop area in the United States. In Oklahoma, northern Arkansas, southeastern Kansas, Missouri, Illinois and Indiana, where May rainfall exceeded 8 inches, nearly 4 million acres of crop land were flooded and on a third of this acreage, it is too late to replant with the same crops. In an area extending from Oklahoma into Missouri, where rainfall ranged from 12 to 20 inches, losses from flooding and from erosion have been distressingly heavy. In part of the wet area a favorable break in the weather during late May and early June permitted the delayed planting to go forward with a rush. Farmers are obviously doing their best under handicaps.

In Illinois, where many of the tractors were kept running 24 hours per day, the percentage of the corn acreage planted increased at a record rate, from 11 per cent on May 29 to about 65 per cent a week later; but then planting was again interrupted by rain. Presumably nearly the usual acreage of these crops will finally be planted in most of these States but both the acreage and the

kind of crops planted will depend on when the farmers can get into the fields. In Oklahoma, the season is so late and damage has been so heavy that some farmers will abandon their crops and seek other employment. Most of them, however, are expected to replant part of the damaged cotton and substitute sorghums, peanuts, soybeans and emergency forage crops for corn and other crops lost.

In the eastern Corn Belt, full acreages of corn and soybeans are to be expected if the weather permits. There may be some substitution of quicker maturing varieties for those usually grown if planting is further delayed. In New York and Michigan, where the late spring and persistent rain have delayed work, some grass land which farmers had intended to plow may be left for hay. Throughout the whole wet area plans and prospects vary, depending in part on the drainage conditions, on breaks in the weather, and on the reserves of power and labor available for the emergency. Farm work is weeks late and there are too many jobs to be done at the same time. As a result, the ordinary operating schedules of individual farmers are badly upset.

Although the season has not advanced far enough to permit precise forecasts, signs of success and failure are beginning to appear. The heavy May rainfall, averaging an inch more than normal in farming areas of the United States, and the liberal and better distributed rains in early June, give promise of a good growth of grass for hay and pasture. With a record number of cattle being raised and hay in demand, farmers will cut a large acreage of hay if the labor is available and the weather permits. The production that may be expected, plus the large carryover, would result in a slightly larger total hay supply than was available in any year prior to 1942, but the supply per unit of livestock now seems likely to be only about normal and slightly less than in any of the last 5 years.

Winter wheat has been hurt by drought in the Great Plains area and by wet weather in the eastern Corn Belt. Spring wheat, including a considerable acreage sown where the winter wheat was killed, is now favored by generally good moisture conditions. The total wheat crop now seems likely to be about 731,000,000 bushels. This would be about the same as the average for the 1932-41 decade, which includes the drought years, but about 150,000,000 bushels below the average of the last 5 years. Oats and barley could not

(Continued on page 20)

Ammonium Nitrate for Fertilizers

At the request of the WPB, a conference was held on June 7th to consider problems relating to the production of ammonium nitrate compounds of improved physical properties. Representatives were present from the Nitrogen Unit, War Production Board; Office of Production, Research and Development, WPB; Ordnance Department of the Army; Soil and Fertilizer Investigations, Department of Agriculture; Tennessee Valley Authority; Hercules Powder Company; Department of Munitions and Supply, Canada; and Allied War Supplies Corporation, Canada.

The experimental work performed at various locations pointing toward the improvement of ammonium nitrate condition was discussed. The experimental work consisted of treatments to prevent caking and to resist the absorption of moisture. Exploration has been made of graining, granulation, and coating methods, and the work is now well advanced on the conditioning of ammonium nitrate for direct application. The materials already produced show great improvement in the physical condition of ammonium nitrate.

Grained and coated ammonium nitrate is already being produced in California, and the product is apparently meeting the requirements for West Coast conditions. TVA has produced and distributed treated materials for large-scale tests on farms. The Canadian plants have recently produced two types of granular ammonium nitrate in carload quantities for test purposes. One Canadian plant is now producing a coarse crystal-conditioned product that apparently has much better properties than their former product.

Waste and Spent Sulphuric Acid

The U. S. Department of Agriculture is investigating the possibilities of using waste and spent sulphuric acid in the production of superphosphate to meet the increased demands for the latter during the 1943-44 season. In a recent letter, K. D. Jacob, senior Chemist, Division of Soil and Fertilizer Investigations, U. S. Department of Agriculture, writes as follows:

"As you know, the requirement of superphosphate estimated for the crop year 1944 amounts to a very large increase over the quantity produced and used in 1943. To meet this requirement, it will be necessary, among other things, to make complete use of

every possible source of sulphuric acid, including waste and spent acids from other industries to the extent that such acids can be utilized without the introduction of substances that may be harmful to plant life. During the past year we have carried out greenhouse and field tests of superphosphates made with spent acids from three different sources, and have defined the conditions under which these acids can be safely used in the manufacture of superphosphate.

"We believe there are spent and waste sulphuric acids from other sources, which could be used for superphosphate production but which are not being used because of the fear that they may contain deleterious substances. We are very desirous of knowing the locations of such acids, and we are prepared to undertake promptly, experiments to determine whether superphosphates made therewith are safe sources of phosphorus for plants."

Anyone having information as to sources of such acids should write to Mr. Jacob, whose address is Plant Industry Station, U. S. D. A., Beltsville, Md.

Fertilizer Consumption, 1942

New York

Prof. E. L. Worthen of Cornell University has completed his annual survey of fertilizer consumption by grades for calendar year 1942, in cooperation with the Association. The tonnage of all mixed fertilizers sold totaled 254,151, of which 169,996 tons represented approved grades, and 84,155 unapproved grades. Twelve analyses included 200,887 tons or 79.4 per cent of the total mixed goods tonnage. These analyses, in order of rank, are as follows: 5-10-5, 4-8-8, 5-8-5, 3-12-6, 4-8-12, 4-12-4, 5-10-10, 4-8-5, 2-8-10, 2-12-6, 4-16-4, and 0-14-7. The superphosphate tonnage reported (including AAA distribution) totaled 184,562 tons, and all other materials totaled 26,952 tons.

West Virginia

Dr. G. G. Pohlman, head of the Agronomy Department at West Virginia University, has completed a grade survey for calendar year 1942, showing that total sales of mixed fertilizers and materials were 47,665 tons. Mixed fertilizer sales totaled 35,162 tons, of which 75.5 per cent was represented by eight grades, namely, 4-12-4, 5-10-10, 2-12-4, 2-12-6, 0-14-7, 3-12-6, 2-8-10, and 4-8-8. Superphosphate sales totaled 10,757 tons, all other materials 1,746 tons.

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A. A. WARE, EDITOR

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Allocation of Potash

Although a record production of potash is anticipated during the next twelve months, the War Production Board has found it necessary to allocate less potash to the domestic fertilizer industry than was permitted in the same period last year, the Fertilizer Materials Unit of the Chemicals Division announced on June 15th.

Allocations to industrial and chemical users were about the same as last year, although some uses were reduced as much as 20 per cent. New requirements in the production of synthetic rubber, high octane gasoline, and as fluxes in aluminum and magnesium production prevented an over-all reduction for industrial uses. Period Two allocations of potash to the fertilizer mixers cover the ten months, June, 1943, through March, 1944, and are expected to be about 90 per cent of the total available for the 1943-1944 fertilizer year. Period I (April-May, 1943) began with the issuance of the potash order, M-291. Period III covers April-May, 1944.

Allocations of high grade potassium chloride to Canada are somewhat greater than last year, whereas sulphate of potash remains about the same and run-of-mine salts have been reduced to compensate for the increase in refined muriate. The reduction in the United States' agricultural tonnage is due primarily to an over-all increase in requirements for export to Allied Nations and to the increase in quantities which are being required in the manufacture of essential and civilian products.

The domestic fertilizer industry will receive somewhat less high grade muriate, more 50 per cent muriate, more run-of-mine salts (manure salts), about the same quantity of sulphate of potash, and considerably more sulphate of potash-magnesia than was available during the 1942-1943 season. In terms of plant food, allocations are about 90 per cent of deliveries in the corresponding period last year.

The domestic potash industry is operating seven days a week, twenty-four hours a day, at capacity levels. It should be emphasized that smaller tonnages available for domestic agricultural use are due entirely to changing war needs rather than a decreased production

New Amendment to Revised MPR 135

The Office of Price Administration issued on June 18th Amendment 3 to Revised MPR 135, which covers mixed fertilizers, superphosphate and potash. The Amendment removes, as a condition of a dealer's using the specific margins set forth in Appendix C, the requirement that the manufacturer during the base period had no consumer prices in effect for the dealer's sales area. Under the Regulation as now amended, the dealer, in establishing his maximum price to consumers, must use the Appendix C margins if the manufacturer, during the base period, provided no "suggested" dealers' prices to consumers or "recommended" dealer margins, for the dealer's sales area.

Section 1367.43 (c), relative to adjustable prices, is revoked. A new section—1367.40 (c)—on adjustable prices (1) permits agreement to sell at a price which can be increased up to the maximum price in effect at the time of delivery, but (2) prohibits, unless authorized by OPA, delivery or agreement to deliver at prices to be adjusted upward in accordance with action taken by OPA after delivery.

A new section—1367.41 (c)—expressly provides that purchases, sales or deliveries of mixed fertilizer and superphosphate imported into the continental United States are not governed by MPR 135, but by GMPR and especially Revised Supplementary Regulation No. 12.

Potash mixed with agricultural liming materials is covered in a new section—1367.44 (4) which permits adjustment of manufacturers' and dealers' maximum prices for the lime-potash mixture in an amount equal to the increase or decrease in the maximum price of the liming material (under MPR 386), in proportion to the amount of the liming material contained in the lime-potash mixture.

Hart Appointed OPA Analyst

W. T. Hart has been appointed Senior Price Analyst in the Agricultural Chemicals Section of OPA, effective June 1st. Mr. Hart has had many active years experience in the fertilizer business, having held responsible positions with The Baugh & Sons Co., The American Agricultural Chemical Co., Chilean Nitrate Sales Corp., and The Barrett Co. Most recently he has been employed by the Ordnance Department of the United States Army.

Supreme Court Denies Florida Tax on AAA Fertilizers

The U. S. Supreme Court, in an opinion filed on June 1st, held that Florida State officials cannot collect, as to fertilizer distributed in that State by AAA, the fertilizer inspection fee imposed by the laws of that State. The case went to the Supreme Court upon appeal from a decision by a three-judge Federal Court at Tallahassee which enjoined the State officials from collecting the fee. The Supreme Court said that under the U. S. Constitution "the activities of the Federal Government are free from regulation by any State. These inspection fees are laid directly upon the United States. They are money exactions the payment of which, if they are enforceable, would be required before executing a function of government." The Court said, however, that, "it lies within Congressional power to authorize regulation, including taxation, by the state of federal instrumentalities."

Since the decision of the three-judge Court last fall, companion bills have been introduced into Congress, to require the Department of Agriculture or any other agency of the U. S. Government, in distributing fertilizer or soil-conditioning or fertilizer material to farmers, to be subject to and comply with the inspection laws of the State within which such distribution is made.

Obituary

LESLIE WEIL

Leslie Weil, senior partner of H. Weil & Bros., fertilizer manufacturers of Goldsboro, N. C., died from a heart attack on June 7th. He had been a trustee of the University of North Carolina for 26 years and was one of the most prominent and highly respected citizens of the State. He was a cousin and business partner of Lionel Weil, a director of the National Fertilizer Association.

MARION F. SMITH

Marion F. Smith, an officer of the Wm. B. Tilghman Company, of Salisbury, Md., died on June 15th, at the age of 49 years. Mr. Smith, who had been connected with the Company for more than 20 years, held the position of Secretary-Treasurer at the time of his death. He is survived by his widow, Mrs. Winifred Adkins Smith, and by two brothers and a sister.

Allocations of Ammonia Solutions and Fertilizer Chemicals

The Nitrogen Unit of WPB has sent a letter to each fertilizer manufacturer advising him as to quantities of solutions, sulphate of ammonia and ammonium nitrate for mixing, and of ammonium nitrate for direct application, he may order immediately, for delivery in approximately equal monthly quotas, for the period July 1, 1943, to June 30, 1944. The letter states that the tonnage of nitrogen for mixing purposes indicated therein will be supplemented from time to time as materials are available and after reports of July 1 inventory have been received. It is stated also that after July 1, 1943, a letter outlining a plan for distribution of nitrogen top dressing materials (other than ammonium nitrate) will be submitted to the industry. The working of the letter is as follows:

Gentlemen:

The Fertilizer Industry Advisory Committee in a meeting held May 12, recommended that all fertilizer operators be notified regarding the prospective supplies of raw material for next year and that an early announcement be made regarding Federal regulations of fertilizer production and distribution during the 1943-44 season to facilitate the early movement of mixed goods to consumers. Pursuant to this recommendation the Nitrogen Unit of the WPB has set up the following pattern for allocation of nitrogen for mixed fertilizer.

Present indications are that there will be more nitrogen in 1943-44 than was available in the fertilizer year now closing, but a larger portion of the supply will be in the form of solutions and ammonium nitrate—materials that cannot be stored at producing plants. It is, therefore, incumbent upon industry to plan early for production and distribution throughout the year, and to this end careful consideration has been given to plans for the allocation of nitrogen supplies. Nitrogen is basic to the production of military explosives and, therefore, it is quite impossible to allocate the entire nitrogen supply for a forward period of one year. The present statistical position would indicate that it should be possible to consider immediately, allocations of

approximately three-fourths of the quantity of nitrogen consumed in the base period July 1, 1941 to June 30, 1942.

Failure to arrange shipments at the maximum rate of production would result in a decrease in the nitrogen available, through curtailment of ammonia plant operations. The tonnage lost through such curtailment could not be reclaimed, as plants will be operating at capacity. Should reduction in available supplies necessitate cancellation of any part of your nitrogen, such cuts would apply only prorata against the unshipped tonnage and would not apply against shipments already made. Should increased supplies justify further distribution, the buyer that had anticipated his quotas, would benefit by being in position to absorb such additional material.

With the objective of aiding the manufacturer in getting an early start on fertilizer production for the coming year the following tentative program is set up for your company. Although this program is primarily concerned with the distribution of inorganic nitrogen for mixed fertilizer production, a provision has been made in this schedule for ammonium nitrate for direct application. This is deemed desirable in that it would permit the fertilizer manufacturer to utilize his shipments in the early part of the season for mixing and later deliveries for direct application, provided that the tonnage used for both is in the same relative proportion as the allocation.

You may place your orders immediately for the quantities indicated below for delivery in approximate equal monthly quotas.

For Mixing Only—Period July 1, 1943 to June 30, 1944

..... Cars UALB du Pont
..... Cars Barrett Solution basis 2A
..... Tons Sulphate of Ammonia
..... Tons Ammonium Nitrate basis 34 per cent

For Direct Application Only—Period July 1, 1943 to June 30, 1944

..... Tons Ammonium Nitrate basis 34 per cent

Total Ammonium Nitrate Tons

Cyanamid is to be used exclusively for conditioning mixed goods and may be used within moderate limitations, but any tonnage ordered will be applied against the sulphate of ammonia allocation on the basis of "ton for ton" as in 1942-43.

Those having no facilities for using nitrogen solution and in a position to arrange with a superphosphate producer to ammoniate, may as far as supply of solutions permit, exchange ammonium nitrate for solution on equal nitrogen basis. Any proposed arrangements of this type should be reported to this office at once.

(Continued on page 22)

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FERTILIZER MATERIALS MARKET

NEW YORK

Allocations of Sulphate of Ammonia and of Potash Being Made. Manufacturers Learning Use of Ammonium Nitrate. Distribution of Organic Nitrogen Arranged but Complicated by Feed Demand. Demand for Superphosphate Still Great.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, June 15, 1943.

Sulphate of Ammonia

Allocations for inorganic ammonia have now been received by fertilizer manufacturers, such allocations assigning sulphate of ammonia, ammonium nitrate and solutions. The allocations cover a twelve months period and the buyers are now starting to place their contracts for these materials.

Potash

Potash allocations have also been received by the fertilizer manufacturers who have now started to place their orders for their potash requirements for the second period, but with allocations for ammonia and potash arriving at the same time, most of the buyers have not as yet worked out the distribution and there is therefore some delay in the placing of orders. In the potash allocations, many of the buyers are required to take considerable quantities of manure salts as well as the 50 per cent grade of muriate, which is making the distribution a little more difficult as the delivered price of the unit of K_2O on the lower grade salts must naturally be taken into consideration in figuring where deliveries can be taken.

Ammonium Nitrate

The allocation of rather large quantities of this material is giving considerable concern to many of the buyers but with the anticipated large quantities of this material available, the fertilizer manufacturer will have to become educated in its use.

Organic Nitrogen

The War Food Administration in Washington is now attempting to obtain a fairer distribution of organic nitrogen supplies for the fertilizer manufacturer and has issued an order so that manufacturers may acquire 70 per cent of the quantity of organic nitrogen used by them during the 1941-42 season for

the new season. If this quantity can be obtained by the fertilizer manufacturer, it will certainly help the situation, but with the demand for organic nitrogen by the feed manufacturers, time alone can tell whether the fertilizer manufacturers will be able to obtain this quantity of material.

Superphosphate

While the total production for the first months of this year was considerably larger than during a similar period of last year, the stocks on hand have diminished considerably and demand is far in excess of production, with every indication that this situation will become worse. It is expected that certain quantities of high grade superphosphate will be allocated for the New England District during the last six months of this year but no definite allocations have as yet been given. It is expected that all the high grade superphosphate in excess of the allocation for New England will be shipped against Lend-Lease.

BALTIMORE

Manufacturers Ordering Next Season's Materials. Feed Demands Make Organics Scarce. Limited Fish Catch Expected.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, June 15, 1943.

The spring fertilizer season is now virtually at an end, and manufacturers are more or less concerned about supplies of raw materials for another year.

Ammoniates.—It looks as though organic ammoniates have ceased to be utilized for fertilizer in view of the higher market prevailing on feeding material. While last season a limited tonnage of vegetable meal was used for fertilizer, according to present indications it would appear that even this form would be utilized for other purposes than fertilizer.

Sulphate of Ammonia.—Manufacturers are

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YOU ON YOUR
REQUIREMENTS
OF THESE
MATERIALS

+
 PHOSPHATE ROCK
 +
 SUPERPHOSPHATE
 +
 DOUBLE
 SUPERPHOSPHATE
 +
 NITRATE of SODA
 +
 SULPHURIC ACID
 +
 SULPHATE of
 AMMONIA
 +
 BONE MEALS
 +
 POTASH SALTS
 +
 DRIED BLOOD
 +
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Birmingham, Ala.	Houston, Texas	San Juan, P. R.
Chicago Heights, Ill.	Jacksonville, Fla.	Sandusky, Ohio
Cincinnati, Ohio	Montgomery, Ala.	Wilmington, N. C.
Columbia, S. C.	Nashville, Tenn.	

now booking orders subject, of course, to Government regulations for delivery during the coming year in connection with liquid ammonia. It is anticipated there will probably be a larger percentage of sulphate of ammonia available for fertilizer, but any deficit will have to be made up in the form of liquid ammonia.

Nitrate of Soda.—No change in the situation, and this commodity will probably continue to be handled under Government regulations as heretofore.

Fish Scrap.—On account of limited territory in which commercial fisherman can operate, it is anticipated the catch during the summer will probably be limited and all used for feeding purposes, on account of the higher market obtainable in that direction as compared with fertilizer material.

Superphosphate.—Manufacturers are now booking orders at recently announced ceiling price of 64 cents for run-of-pile, in bulk, f.o.b. producers' works, Baltimore, as buyers realize that with the continued shortage of labor the cost will gradually work higher with little prospect of any decline. Due to the good demand for sulphuric acid there is no surplus stock of superphosphate being carried over.

Potash.—Practically all producers have now practically booked up for their estimated production, and it is expected that they will be able to supply the legitimate manufacturing requirements of fertilizer manufacturers again this year.

Bone Meal.—Both raw and steamed bone meal are ruling high, due to the impossibility of importing raw or steamed bone meal. The nominal market is in the neighborhood of \$50.00 per ton, which is entirely out of proportion with mixed fertilizer as plant food, in consequence of which there is little business being done.

Bags.—There is nothing new in the situation, and it is now beginning to look as though fertilizer manufacturers will be compelled to

use paper bags for the duration as there are no stocks of burlap accumulating in this country.

PHILADELPHIA

End of Season Finds Mixers Looking for Future Materials. Government Issues Orders on Organics, Chemical Nitrogen and Potash.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, June 14, 1943.

Now that the shipping season has passed in this section, mixers are beginning to try to line up contracts for materials for fall and spring deliveries, and in these days that is not an easy job.

Otherwise, during the past couple of weeks the news was featured by a revised WFA Order No. 12, which in effect states that mixers may acquire up to 70 per cent of the organic nitrogen products they used last season; and the WFA has given permission for the use of chemical nitrogen on fall grain.

Ammoniates.—The clarifying order from WFA on organic nitrogen was welcomed apparently by the trade, for now it is known just what is expected of them. However, so far all organics are still not plentiful.

Sulphate of Ammonia.—WPB has allocated this material for the 12-month period, starting in July, for the fertilizer mixers.

Nitrate of Soda.—Allocations of this for fertilizer purposes have been granted in full.

Superphosphate.—Triple superphosphate remains in a fairly scarce position owing to exports, but some mixers are turning to the lower grades as substitutes.

Bone Meal.—Position remains about the same as previously reported, with demand continuing, and supply low.

Potash.—Order has just come out on this date, establishing definite dollar and cents ceiling prices for the potash materials, such as muriate, sulphate, manure salts, etc. Demand is high, and materials are scarce.

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Sales Agents

for **DOMESTIC**

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Ammonia Liquor

::

Anhydrous Ammonia

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CHARLESTON

Revised FPO No. 12 to Help Use of Fertilizer Organics but Producers Unwilling to Quote. Allocations on Fertilizer Chemicals.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, June 14, 1943.

The War Food Administration has issued FPO No. 12, revised. Under this order the fertilizer manufacturer is allowed to purchase organics for use in mixed goods or for sale to home mixers to the extent of 70 per cent of his purchases of organic nitrogen used in the period of July 1, 1941 to June 30, 1942. However, at present as the Government is trying to get a roll-back in the price of organics, none of the producers of nitrogenous are willing to quote.

Dried Blood.—Still \$5.38 per unit of ammonia (\$6.54 per unit N) f.o.b. Chicago. This material is still going all to feed.

Sulphate of Ammonia.—Allocations have just been made by the WPB for this material for mixing purposes and the fertilizer manufacturers have also been allotted nitrogen solutions and ammonium nitrate.

Nitrate of Soda.—The price of this material for June shipment is unchanged.

Cottonseed Meal.—The 8 per cent grade is quoted at \$38.50, Atlanta.

Soybean Meal.—This material is priced at \$45.20, Atlanta.

CHICAGO

Feed and Fertilizer Organics Market Quiet. FPO No. 12 Has Not Stimulated Sales to Date. Roll-back in Prices Expected.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, June 14, 1943.

Quiet conditions continue dominating the organic and fertilizer materials markets. The revised FPO No. 12 will undoubtedly stimulate some business in the near future, but no

sales based on the conditions of that order have as yet been announced.

If the demand for bone meal for feed purposes remains as active as at present, there will be but little of that article for fall fertilizer business, and surely not nearly sufficient to supply the normal requirements.

In the meantime, no change in ceiling prices, though ceilings on organic fertilizer materials are seemingly in line for roll-back.

No change in ceiling prices: High grade ground fertilizer tankage, \$3.85 to \$4.00 (\$4.68 to \$4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, \$5.53 per unit ammonia (\$6.72 per unit N); blood, \$5.38 (\$6.54 per unit N); dry rendered tankage, \$1.21 per unit of protein, Chicago basis.

TENNESSEE PHOSPHATE

Dry Weather Retarding Crops. Defluorinated Phosphate for Feed Being Investigated. Rock Shipments and Orders at Peak.

Exclusive Correspondence to "The American Fertilizer"

COLUMBIA, TENN., June 13, 1943.

The extra precipitation of May held up in June and only scattered thunder showers have come so far in June with very dry victory gardens as well as all sorts of farm complaints.

All the small grain is cut and there will be a heavy drop from last year's crop, while corn and tobacco vary through wide extremes from the very early to the very late plantings, and many fields are still unplanted.

The local alfalfa field which was top dressed with finely ground phosphate rock late in February has been much admired by all, and yielded ten big loads from 5 acres first cutting, while it is again ready for second cutting about June 16th.

It is reported that some extensive experiments are being promoted by some fertilizer



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GRANULAR MURIATE OF POTASH, 48/52% K_2O . MANURE SALTS, 22/26% K_2O

manufacturers to learn whether mixtures of phosphate rock with ammonium sulphate and muriate of potash should be added to permissible mixtures for sale, and, of course, whether the present control laws prohibiting sale of such mixtures should be amended.

There is continued activity in shipments to all consuming channels, with considerable increase in shipments of ground rock to manufacturers of mineral mixtures for livestock feeding, on account of the practical inability to secure bone meal for that purpose.

The ceiling price of \$30.00 per ton fixed for defluorinated phosphate to take the place of bone meal and dicalcium phosphate for livestock feeding has stimulated production but so far only superphosphate is being defluorinated as far as learned.

If there were any prospect of that ceiling being maintained, there would be considerable defluorination of phosphate rock, but with the certainty that price would drop whenever bone meal is again obtainable at \$25 to \$30 per ton, there is little temptation to make the installations and incur the extra cost, as long as the straight phosphate rock has been satisfactory to users for so long.

Shipments of ground rock for direct application have aggregated nearly 70 per cent larger up to June 1st than for same period in 1942, and all sellers are in possession of unfilled orders for more than their capacity for rest of 1943. Many orders are already booked well into 1944 and recently one farmer placed large orders for 1944, 1945 and 1946, trying to make certain of shipment when wanted.

Union labor troubles have seriously interfered with bagging and loading to some extent so far in June and such troubles are apt to increase with the general labor conditions over the country.

When the miners were hard pressed to make a living during the depression, there was little trouble with unions, but since they have been making good wages, agitators are very active.

**THE BEST TOP-DRESSING FOR VICTORY!
A LIBERAL PURCHASE OF WAR BONDS AND
STAMPS.**

JUNE CROP REPORT

(Continued from page 10)

all be planted in Michigan, Ohio and New York because of wet weather and yields will be low in the Southwest but prospects are better in the main producing States and a large crop of barley and a fairly good crop of oats are now indicated. Corn is off to an abnormally late start, with probably 15 million acres still to be planted after June 1. Good growing weather will be needed to mature late plantings ahead of frost.

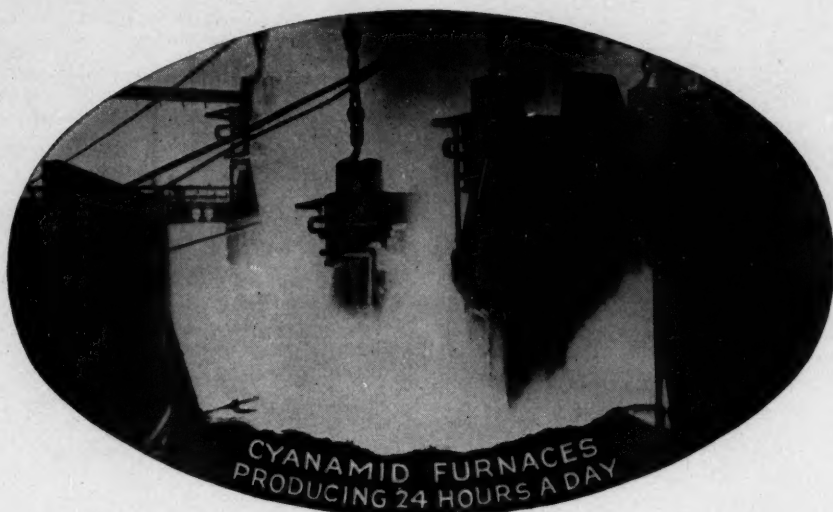
Excessive moisture over most northern commercial truck crop areas delayed planting, prevented cultivation, and retarded growth of some crops. Acreage of early-season crops in these areas may fall below expectations because of the inability of growers to plant at the proper time, but where possible later-maturing crops will be planted on this acreage. In southern and western sections, which furnish the bulk of supplies for shipment during the spring months, conditions during the second half of May were favorable for the most part.

Combined production of all commercial truck crops for the fresh market estimated to date, is 13 per cent below corresponding production in 1942, but 2 per cent above the 1932-41 average. About one-half of the total volume of truck crops is included in these estimates to date. Snap beans, carrots, and kale are the only crops showing greater production in 1943 than in 1942, with beets showing a reduction of only 3 per cent and asparagus and tomatoes 5 per cent each. Estimates covering about four-fifths of the total acreage of truck crops indicate an 11 per cent reduction from the corresponding acreage harvested in 1942. Excluding cantaloupes and watermelons, the reduction is only 7 per cent.

Growers of processing crops in important northern producing areas were unable to do much field work during May because of excessive rains and floods. The delay was particularly serious in New York and westward to Illinois. The net effect of this condition on the acreage that will finally be planted to processing crops has not yet been determined.

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On the farm, in addition to application as a spring and fall fertilizer, Cyanamid is used to control weeds in oats; as a weed repellent for asparagus; and throughout the year, for plowing under with green-manure crops or crop residues to build up a rich humus supply in the soil.

The demand for Cyanamid is growing because of its many uses; and because it contains both nitrogen and lime — a combination to which most soils respond very favorably.

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ALLOCATION OF AMMONIA SOLUTIONS AND FERTILIZER CHEMICALS

(Continued from page 14)

It has been stressed above that buyers should spread receipts in approximate equal periodic deliveries throughout the year. For example, a buyer of 12 cars of solution should arrange for one car monthly; buyers of 6 cars should arrange for delivery of a car every two months and those raking two cars of solution should arrange to accept delivery of one car prior to December 31, 1943. In the case of ammonium sulphate, a buyer of 600 tons should arrange to accept 50 tons monthly, while an annual purchase of 200 tons should be scheduled at the rate of 30 to 35 tons every two months. An annual delivery of 240 tons of ammonium nitrate should be scheduled at the rate of 40 tons every two months.

Should you fail to take delivery of your quota during any month or period, such quota will be cancelled with no assurance of its being replaced later. Should you be able to anticipate later quotas and take delivery of tonnage in excess of your quotas during period July 1-December 31, 1943, we will approve if the material is available after caring for other requirements.

Those companies operating plants in more than one state may pool their various state quotas and distribute the materials to their individual plants, in accordance with their own manufacturing program, provided: (1) the total units of inorganic nitrogen quotas assigned a particular state be shipped to plants in that state; and (2) that the total number of cars of solution or the total number of tons of each material shipped, be the same as the quota assigned to the company as a whole, and comply with ODT cross-haul limitations.

It is imperative that orders be placed with suppliers not later than the 5th day of the month preceding the month of delivery, otherwise your supplier may make delivery to others, subject to approval by this office.

The America farmers requirements of nitrogen in 1943-44 will reach an all-time high and every effort will be made by the War Production Board to make available the maximum amount, with due consideration for other military and civilian requirements.

The importance of taking the solutions or ammonium nitrate and ammonium sulphate in the proportions outlined, cannot be over-emphasized, and it is the only manner in which maximum production can be obtained.

Because it is necessary for agriculture to absorb the largest possible amount of nitrogen in the form of solutions or ammonium nitrate, ammonium sulphate can be supplied only in proportion to the amount of solutions or ammonium nitrate for mixing which the fertilizer manufacturer accepts. It is of paramount importance that mixing formulas for the coming year, should be evolved on the basis of first preference for ammonium nitrate and solutions as nitrogen carriers and that the use of ammonium sulphate be reserved, insofar as it is practicable to do so, for raising the nitrogen analysis in the final product.

The tonnage of nitrogen for mixing purposes indicated in this letter shall be supplemented from time to time as materials are available and after reports of July 1 inventory have been received.

At some date after July 1, 1943 a letter outlining a plan for distribution of nitrogen top dressing materials (other than ammonium nitrate) will be submitted to the Industry.

The splendid cooperation of the American fertilizer industry in carrying out the nitrogen program for 1942-43 was appreciated and it is hoped that all fertilizer producers will cooperate during the coming year. A letter similar to this is going to all producers of record in the Nitrogen Unit.

POTASH PRICE CEILINGS ESTABLISHED

(Continued from page 9)

(2) On f.o.b. car sales, except for sulphate of potash and sulphate of potash magnesia, at the spot sales prices and at the discounts and under the conditions above set forth, and, except for manure salts, at a further deduction of 8 cents per unit of K_2O in the case of sales f.o.b. cars at Trona, California and a deduction of 11.2 cents per unit of K_2O in the case of sales f.o.b. cars at seller's plant near Carlsbad, New Mexico.

SEC. 6. *Sales in bags.* The maximum prices herein provided for potash when sold in bags may be increased by the reasonable market value of the bags not exceeding their established maximum prices, plus \$1.00 per ton of potash.

SEC. 7. *Sales of imported potash.* The maximum prices at which potash originating outside of and imported into continental United States, may be sold and delivered to a fertilizer manufacturer, within the United States and any of its territories and possessions, are:

(a) *April and May deliveries.* For deliveries actually made to fertilizer manufacturers during the months of April and May, the maximum spot prices set forth in section 4 above;

(b) *June through March deliveries.* For deliveries actually made to fertilizer manufacturers during the months beginning June 1 and ending March 31 next succeeding, the maximum spot prices set forth in section 4 above with the discounts and under the conditions set forth in section 5 (a) (1) and (2) above, irrespective of the execution of a contract prior or subsequent to July 1 of any year.

SEC. 8. *Sales of potash by one fertilizer manufacturer to another.* The maximum prices

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at which a fertilizer manufacturer may sell his potsah to another fertilizer manufacturer shall be no more than the applicable maximum spot price hereinbefore established, plus an amount equal to the actual transportation costs, if any, incurred and paid by the fertilizer manufacturer making the sale.

SEC. 9. Transportation tax and other charges.

(a) Upon sales made f.o.b. cars at a producer's plant (irrespective of the plant from which shipment is made), the transportation tax imposed under section 620 of the Revenue Act of 1942 and all other transportation charges shall be paid by the buyer;

(b) On sales basis ex-vessel the port nearest freightwise to the buyer, the transportation tax imposed by section 620 of the Revenue Act of 1942, and other necessary transportation charges, except customary wharfage, handling and transportation charges to the buyer's destination, shall be the obligation of and be paid by the seller.

(c) On sales of 60 per cent muriate of potash, transportation costs payable by the buyer shall be equalized or adjusted so that his actual transportation cost per unit of K_2O will be no greater than such cost would have been had the muriate of potash contained 62.5 per cent K_2O .

FACTORS AFFECTING THE AVAILABILITY OF AMMONIATED SUPERPHOSPHATE

(Continued from page 8)

White, Hardesty, and Ross (14), the phosphatic components formed under the same conditions in the absence of any considerable proportion of calcium sulphate, as in a double superphosphate, consist of about 2 parts of dicalcium phosphate and approximately 1 part each of mono- and di-ammonium phosphates. This product is neutral or alkaline in reaction and loses ammonia on storage. It would be expected that the presence of dolomite would increase the reversion in acid mixtures that contain calcium sulphate, such as Mixture 8, but not in neutral or alkaline mixtures, such as Mixtures 6 and 10, which do not contain calcium sulphate.

The citrate-insoluble P_2O_5 in all the mixtures represented in Table IV was determined by the official method, and a 1 gram sample was used in each case. It will be seen that the P_2O_5 in a 1 gram sample of Mixture 2 is nearly four times as great as in Mixture 5. Because of this difference in dilution, a given quantity of any form of P_2O_5 in the two mixtures will represent a percentage nearly four times greater in Mixture 2 than in Mixture 5. It will likewise follow that the same relationship will

hold true between the ratio of P_2O_5 to the citrate solution used in the analysis of the mixtures. It seemed possible, therefore, that the dilution factor alone might explain the difference in the results found for citrate-insoluble P_2O_5 in Mixtures 2 and 5, and this was confirmed when an analysis of Mixture 2 diluted after storage with the same proportion of sand as in Mixture 5 showed no appreciable citrate-insoluble P_2O_5 . This indicates that if Mixture 2 contained fluorapatite, a like quantity was also present in all the mixtures that contained the same proportion of fluorine, ammonia, and monocalcium phosphate.

The present official method for determining citrate-insoluble P_2O_5 has been generally accepted as a satisfactory procedure for the evaluation of non-ammoniated mixtures. It is also considered to be fairly well adapted to the evaluation of ammoniated mixtures of average P_2O_5 content. However, the results given in Table IV and those now being obtained in a study of the availability of ammoniated mixtures to plants indicate that the methods is unsatisfactory for ammoniated mixtures of varying P_2O_5 content, as previously pointed out (12). If it is assumed that the present official method is satisfactory for ammoniated mixtures of average P_2O_5 content, the results given in Table IV indicate that high values are obtained for available P_2O_5 in ammoniated mixtures of low P_2O_5 content and low values for those of high P_2O_5 content.

Summary

A study was made of the chemical availability of P_2O_5 in ammoniated fertilizer mixtures as affected by the degree of ammoniation, the storage temperature following ammoniation, the moisture content during ammoniation and storage, the sources of super-



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phosphates used in the preparation of the mixture, and the presence of dolomite and of fluorides during ammoniation and storage.

Mixtures containing commercial superphosphates from different sources varied greatly with respect to increase in insoluble P_2O_5 when the degree of ammoniation was increased beyond 2 per cent. There was no appreciable increase of citrate-insoluble P_2O_5 during storage of these mixtures at 20°C. The results of tests in which identical ammoniated products were stored for 36 days at temperatures of 60° and 90°C. indicate that the presence of dolomite in association with sufficient moisture was responsible for such reversion as occurred at storage temperatures above normal. Similar tests were conducted with ammoniated and non-ammoniated mixtures containing synthetic superphosphates prepared from C. P. monocalcium phosphate and calcium sulphate with and without additions of fluoride compounds. The mixtures that simulated a 4-12-4 grade of fertilizer without dolomite contained no significant amounts of citrate-insoluble P_2O_5 even after ammoniation in the presence of fluorides at the rate of 60 pounds of ammonia per ton and storage in a moist condition for two weeks at 75°C.

Treatment of the same quantity of monocalcium phosphate as that contained in the 4-12-4 mixture with the same quantity of ammonia as that used in ammoniating the mixture gave only a slight increase of citrate-insoluble P_2O_5 on storage of the ammoniated sample at 75°C., but this same procedure in the presence of fluorides caused a marked increase in the citrate-insoluble P_2O_5 content, as would be expected.

When this procedure was carried out on the same quantities of materials, but diluted with sand to give a mixture simulating a 4-12-0 fertilizer, no appreciable citrate-insoluble P_2O_5 was detected in the ammoniated product stored at 20° and only a trace at the storage temperature of 75°C. The presence of calcium sulphate in the synthetic 4-12-4 mixture produced an acid condition in the ammoniated product and, in this medium, dolomite increased the reversion of P_2O_5 to an appreciable extent. However, in neutral or alkaline

mixtures not containing calcium sulphate the dolomite did not increase reversion.

These findings demonstrate the effect of dilution on the result obtained for citrate-insoluble P_2O_5 when determined by the official method on a 1-gram sample. This dilution factor holds true with respect to the quantity of P_2O_5 present in a 1-gram sample as for the ratio of P_2O_5 to citrate-solution used in the analysis.

If it is assumed that the present official method for citrate-insoluble P_2O_5 is satisfactory for ammoniated mixtures of average P_2O_5 content, the results obtained in this study indicate high values for available P_2O_5 in ammoniated mixtures of low P_2O_5 content and low values for those of high P_2O_5 content.

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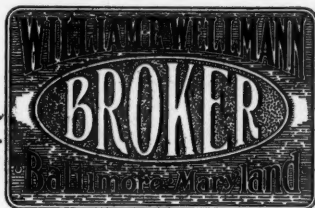
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tion, Equipment . . . Operation . . . Mills-
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Acid-Cooled Chambers, Gaillard Acid Dispersers,
Contact Process Sulphuric Acid Plants.

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DISINTEGRATORS

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat

Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric

Link-Belt Company, Philadelphia, Chicago.

DUMP CARS

Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS

Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS

Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable

Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial

Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway

Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS

American Agricultural Chemical Co., New York City.
American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL

Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS

Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE

Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut

Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent

Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE

American Agricultural Chemical Co., New York City.

GUANO

Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable

Hayward Company, The, New York City.

HOPPERS

Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS

Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE

Tennessee Corporation, Atlanta, Ga.

INSECTICIDES

American Agricultural Chemical Co., New York City.

LACING—Belt

Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE

American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers

Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making

Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling

Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying

Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Link-Belt Company, Philadelphia, Chicago.
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Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping

Atlanta Utility Works, East Point, Ga.
Duriron Co., Inc., The, Dayton, Ohio.

MACHINERY—Tankage and Fish Scrap

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNETS

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE

McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA

American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmalts, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS

Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS

Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL

American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray

Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers

Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS

Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS

Chemical Construction Corp., New York City.

PHOSPHATE ROCK

American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmalts, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Virginia-Carolina Chemical Corp. (Mining Dept.), Richmond, Va.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting

Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware

Chemical Construction Corp., New York City.

PIPES—Wooden

Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid

Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers

American Agricultural Chemical Co., New York City.
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmalts, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers

American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS

Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting

Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers

Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ

Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower

Chemical Construction Corp., New York City.

ROUGH AMMONIATES

Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Schmalts, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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SCRAPERS—Drag

Hayward Company, The, New York City.

SCREENS

Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air

Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating

Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic

Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING

Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power

Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar
Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers

Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS

Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA

American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New
York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SULPHUR

Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID

American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.

SULPHURIC ACID—Continued

U. S. Phosphoric Products Division, Tennessee Corp.,
Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE

American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp.,
Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated

Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp.,
Tampa, Fla.

SYPHONS—For Acid

Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE

American Agricultural Chemical Co., New York City.

TANKAGE

American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland, Norfolk, Va.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage

Huber & Company, New York City.

TANKS

Sackett & Sons Co., The A. J., Baltimore, Md.

TILE—Acid-Proof

Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption

Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat

Hayward Company, The, New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA

DuPont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR

DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting

Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROW (See Carts)

ZINC SULPHATE

Tennessee Corporation, Atlanta, Ga.

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COCOA MEAL

Inquiries Invited

SAMUEL D. KEIM

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 PHILADELPHIA, PENNA.**

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See Catalog 6-C

Fig. 6080

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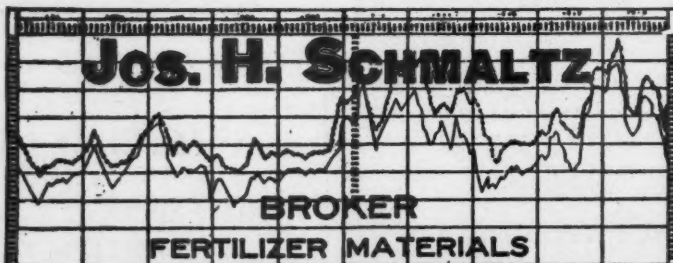
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VICTORY in the DESERT

NUMBER 5 IN A SERIES OF PROGRESS REPORTS ABOUT POTASH

HITLER WILL REMEMBER THIS AMERICAN DESERT VICTORY, TOO

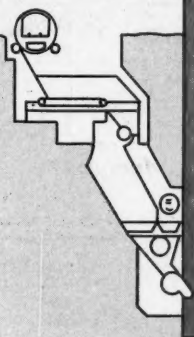
Have you ever stopped to think what might have happened if America had lost the Potash battle?

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